

Dec. 11, 1956

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2,774,033

FIRING POINT INDICATOR FOR INTERNAL COMBUSTION ENGINES

Filed Nov. 21, 1952

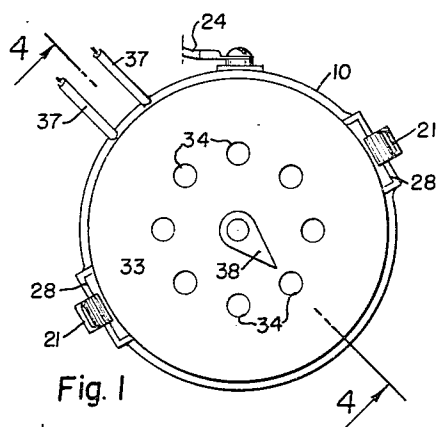


Fig. 1

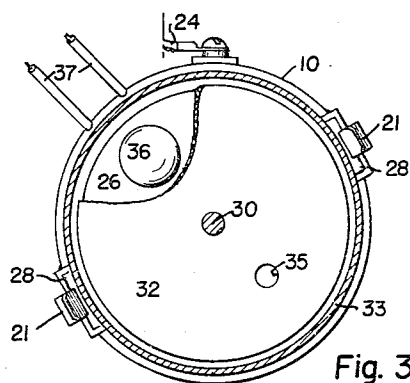


Fig. 3

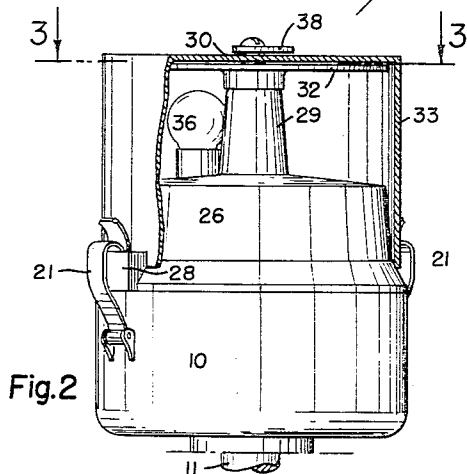


Fig. 2

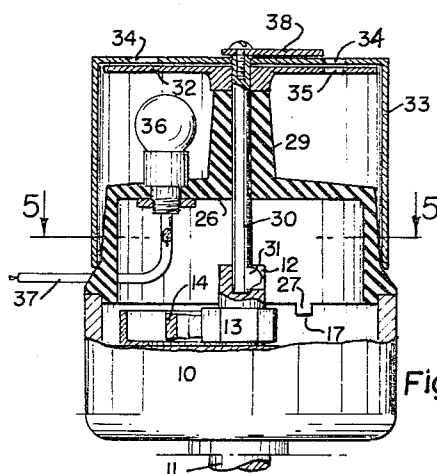


Fig. 4

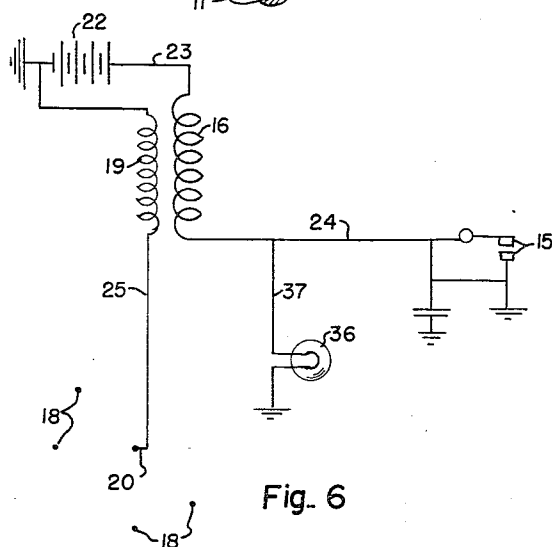


Fig. 6

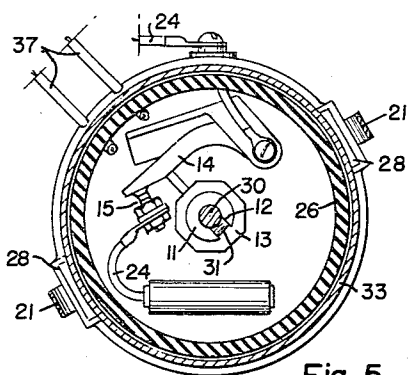


Fig. 5

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FIRING POINT INDICATOR FOR INTERNAL COMBUSTION ENGINES

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Application November 21, 1952, Serial No. 321,798

2 Claims. (Cl. 324—16)

This invention relates to adjunctive devices employable in the servicing and maintenance of internal combustion engines to determine and to positively indicate the firing point or points of the engine, whereby to facilitate adjustment and correlation of the engine elements, and has as an object to provide a novel and improved unit susceptible of cooperative association with conventional engines to accomplish the functions above set forth.

A further object of the invention is to provide a novel and improved firing point indicator convenient of efficient use in substitution for a typical member of conventional internal combustion engine ignition systems.

A further object of the invention is to provide a novel and improved unitary facility employable in substitution for the usual distributor cap member of an internal combustion engine to precisely and positively indicate the engine cylinder firing points.

A further object of the invention is to provide a firing point indicator employable in association with elements of a multi-cylinder engine ignition system to reflect internal combustion engine element disposition and relationship with reference to the established firing cycle of the engine.

With the foregoing and other objects in view, my invention consists in the construction, arrangement, and combination of elements as hereinafter set forth, pointed out in my claims, and illustrated by the accompanying drawing, in which—

Figure 1 is a top plan view of a preferred embodiment of the invention as mounted on and associated with conventional ignition system elements ready for practical use.

Figure 2 is a side elevation of the organization according to Figure 1 with certain portions broken away to disclose otherwise concealed arrangements.

Figure 3 is a cross section taken substantially on the indicated line 3—3 of Figure 2 with a portion of the view broken away to disclose otherwise concealed arrangements.

Figure 4 is a section axially of the illustrated embodiment taken substantially on the indicated line 4—4 of Figure 1.

Figure 5 is a cross section taken substantially on the indicated line 5—5 of Figure 4.

Figure 6 is a conventionalized diagram of the electrical circuits and connections availed of in use of the improved device.

Many and diverse operations incident to the servicing and maintenance of internal combustion engines, particularly multi-cylinder such engines of automotive type, are referred to the firing cycle of the engine and the particular cylinder firing points as a basis determinative of engine element dispositions and relationships, thus it is expedient and convenient to have available means for precisely determining and indicating the engine cylinder firing points when the engine is inoperative and perhaps partially disassembled, and it is to the provision of such a device adapted for operative association with conven-

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tional engine ignition systems that the instant invention is directed.

High tension ignition systems of battery and coil type employing an interrupter and distributor unit are most extensively utilized in association with multi-cylinder internal combustion engines. Such high tension systems and their operative relationship with internal combustion engines are so well understood as to obviate occasion for elaboration herein, hence the present disclosure, both illustrative and descriptive, includes only those elements of a conventional high tension ignition system wherewith the firing point indicator of the invention is adapted to coact.

As illustrated, the numeral 10 represents the usual lower body or interrupter case of a typical high tension ignition unit, said lower body being characteristically formed as a cylindrical, upwardly-opening cup angularly adjustable by appropriate means, not shown, about an engine-driven shaft 11 journaled through the base of the body 10. In conformity with conventional practice the shaft 11 is gear-driven to rotate with and at a fixedly-proportioned speed relative to the crankshaft or camshaft of the associated engine, thereby to correspondingly reflect angular displacement of its driving member, and the free end of said shaft 11 within and somewhat above the open end plane of the body 10 is notched, as at 12, to mount a rotor member, not shown, conventionally utilized to complete the high tension circuit to the engine spark plugs as said shaft is rotatively driven. Fixed to the shaft 11 within the cup of the body 10, a multi-lobed cam 13 is mounted for repetitious actuation of a spring-loaded hinged arm 14 which carries one of a pair of contacts 15 included in the primary 16 of an induction coil, so that rotation of the shaft 11 is applied through the cam 13 and arm 14 to make and break the coil primary circuit at the points 15, all in accordance with usual practice. When the engine is conditioned for operation, an upper body member, known as a distributor cap, is registered with and to close over the open end of the body 10 in a fixed angular correlation with and on the latter determined by engagement of a lug carried marginally by the distributor cap with a notch 17 formed for its reception in the upper margin of the body 10, and said distributor cap is furnished with a plurality of angularly-spaced contacts 18, in turn connected to the engine spark plugs through the high tension circuit from the coil secondary 19 through the agency of the rotor, indicated at 20, carried on the free end of the shaft 11 as above set forth. For removable and replaceable association of the distributor cap in desired operative relation with the body 10, spring clips 21 hinged exteriorly to opposite sides of said body 10 are arranged to engage with and over blocks fixedly outstanding from the distributor cap in position to register with said spring clips when the distributor cap lug is entered within the notch 17 of the body 10. Operatively conditioning the conventional ignition unit represented and above described, a storage battery 22 connects, as at 23, between a ground and one end of the coil primary 16, and a lead 24 continues the circuit from said primary 16 to ground through the contacts 15. The coil secondary 19 is grounded at one end and provided with a lead 25 from the other end which serves the spark plugs of the engine through the rotor 20 and the distributor contacts 18, so that, the remainder of the organization being properly correlated, separation of the contacts 15 through the action of the cam 13 induces a flow of high tension current from the coil secondary 19 to the particular spark plug at that instant served by the rotor 20 and contact 18 engaged by the latter. Thus, separation of the contacts 15 determines the firing point for that one of the engine cylinders to which a circuit is simultaneously completed by the rotor.

20 in engagement with one of the distributor cap contacts 18.

In attainment of its purposes, the instant invention utilizes the elements 10, 11, 12, 13, 14, 15, 16, 17, 21, 22, 23 and 24 of the conventional engine ignition system shown and described through the agency of an assembly cooperable with the lower body or interrupter case 10 in substitution for the distributor cap conventionally mounted thereon. The assembly characterizing the invention in substitution for the conventional ignition system distributor cap includes a rigid, unitary cap member 26 of appropriate, preferably dielectric, material formed as an inverted cup having a free lower margin coactable with the upper margin of the body 10 to mount said cap 26 on and to close in coaxial registration over said body; a lug 27 fixedly outstanding from the free lower margin of the cap 26 for engagement within the notch 17 of said body member, whereby to fix and determine the angular disposition of the cap 26 relative to the body 10 when said cap is mounted on said body. As in the case of the conventional distributor cap, blocks 28 fixedly and oppositely outstand from the cap 26 in position to be engaged by the spring clips 21 for retention of said cap on and in the desired mounted relationship with the body 10. A boss 29 fixedly upstands centrally from the closed base web of the cap 26 and a bore traversing said boss registers coaxially with the shaft 11 when the cap 26 is mounted on the body 10, a straight stem 30 being rotatively accommodated in and through the said bore of the boss 29 in an extension within the cap 26 appropriate to engage the lower end of said stem 30 with the upper end of the shaft 11 and to rotatively interlock said shaft and stem by virtue of an ear 31 fixedly and radially outstanding from the stem 30 lower end within the notch 12 of the shaft 11 upper end.

Fixed to and rotatable with the upper end of the stem 30 above the boss 29, a circular disc 32 is mounted to spacedly overhang the closed base of the cap 26, and a cylindrical housing 33 is formed with a central opening accommodative of the stem 30 upper end and is sized and conformed to telescope over and in clearing relation about the disc 32 as an enclosure engaging at its open lower end with the cap 26; notches interrupting the lower open end of the housing 33 engaging with and about the blocks 28 to fix and determine the angular relationship of said housing 33 and the associated cap 26.

The upper end of the housing 33 is intersected by a series of like openings 34 uniformly spaced apart in a circle concentric with and about the end of the stem 30 and corresponding in number and relationship with the contacts 18 of the conventional ignition system distributor cap, and a single opening 35 intersects the disc 32 in position to register successively with the individual openings 34 as said disc is caused to rotate by and with the stem 30. Visually indicative of opening 35 registration with any one of the openings 34, an electric bulb 36 is mounted on the base of the cap 26 above said cap and beneath the disc 32 and is served by a lead 37 through the wall of said cap connectable between the lead 24 of the coil primary 16 and ground as a shunt to the circuit including the contacts 15; ends of said lead 37 expediently being furnished with clip connectors, not shown, convenient of attachment and detachment in circuit-completing relation with the lead 24 and a grounding point. The electrical resistance of the bulb 36 being greater than that of the interengaged contacts 15, the bulb will remain unilluminated during the intervals of contact 15 interengagement and will light up in reaction to current flow through the suitably-connected lead 37 only when the circuit through the contacts 15 is interrupted as a consequence of contact separation occasioned by action of the cam 13 reflected through the hinged interrupter arm 14, which occasions of contact 15 separation mark the engine cylinder firing points of the ignition system.

Through engagement of the cap 26 lug 27 in the notch 17 of the body 10, the substitute assembly shown and described is related with the interrupter organization of the conventional ignition system to dispose the housing openings 34 in exact simulation of the contacts 18 of the conventional distributor cap displaced by said assembly, and the rotatable member of the substitute assembly comprised from the stem 30 and disc 32 operatively simulates the rotor 20 of the conventional system in its driven correlation with the shaft 11 and in the correlation of its disc opening 35 with the housing openings 34. Thus, as the shaft 11 is caused to rotate in its customary synchronism with movable elements of the associated engine, the cam 13 functions to repetitiously separate the contacts 15 at and to mark the engine cylinder firing points, the disc 32 revolves to successively register its opening 35 with the housing openings 34 in a progression corresponding with the normal firing order of the engine cylinders and in such driven correlation with the cam 13 as operates to effect opening 35 registration with an opening 34 at each separation of the contacts 15, and the bulb 36 is caused to light by flow of current through its shunt circuit at each such contact 15 separation; such illumination of the bulb occurring when the opening 35 is registered with one of the openings 34 and clearly indicating through the so-registered openings the particular engine cylinder then firing in normal engine operation. The firing order of the engine cylinders being known and susceptible of ready indication on the end of the housing 33 in association with the openings 34, bulb 36 illumination manifest through that one of the openings 34 in registration with the disc opening 35 is a positive and readily-noted indication of engine element dispositions obtaining at the firing point of the so-designated engine cylinder. Supplementing the visual indication afforded by bulb 36 illumination, a pointer 38 may be fixed to and for rotation with the end of the stem 30 exteriorly of the housing 33 to indicate, in an obvious manner, that one of the openings 34 in registration at any moment with the disc opening 35.

Since the substitute assembly of the instant invention replaces the usual distributor cap of the engine ignition system, it is obvious that the invention is designed for use only when the engine is inoperative and when it is important to precisely determine engine element rest dispositions with relation to the firing points of particular engine cylinders, as is of consequence in many engine servicing, maintenance, repair and adjusting operations. Through use of the improvement shown and described, engine element dispositions may be set and determined with reference to the actual engine cylinder firing points as operatively established through separation of the interrupter contacts 15, irrespective of such factors as may adversely affect the reliability of conventional setting indices and gear tooth markings, heretofore largely availed of as guides to engine element dispositions and relationships.

Since changes, variations, and modifications in the form, construction, and arrangement of the elements shown and described may be had without departing from the spirit of my invention, I wish to be understood as being limited solely by the scope of the appended claims, rather than by any details of the illustrative showing and foregoing description.

I claim as my invention:

1. A firing point indicator coactable with the interrupter case of an internal combustion engine high tension ignition system in substitution for the distributor cap of such system, comprising a cap member formed with a closed base adapted to register with and close over the interrupter case, means detachably intercoupling said cap member and interrupter case in a fixed condition of predetermined angular relation, an integral boss formed with an axial bore upstanding centrally from the closed base of said cap member, a rotatable stem axially through

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said boss, an ear on and projecting radially from the stem end within the cap member for engagement within a notch conventionally characterizing the driven shaft of the ignition system, an opaque disc concentrically and perpendicularly fixed to the stem portion exterior of the cap member, a single opening intersecting said disc eccentrically of the stem, a separate, opaque housing shrouding said disc and closing against said cap member with the housing base adjacently covering the disc, means separably intercoupling said housing and cap member in a fixed condition of predetermined angular relation, a series of angularly-spaced like openings intersecting the housing base for successive registration with the disc opening in a disposition about said stem simulative of distributor cap contacts, an electric bulb carried by said cap member within said housing and beneath said disc, and a circuit serving said bulb in shunt relation with the interrupter contact circuit, whereby to illuminate the housing interior between said cap member and disc in automatic reaction to separation of the interrupter contacts when the ignition system beyond the latter is incomplete.

2. A firing point indicator coactable with the interrupter case of an internal combustion engine high tension ignition system in substitution for the distributor cap of such system, comprising a cap member formed with a closed base adapted to register with and close over the interrupter case, a lug marginally of said cap member coactable with a notch conventionally characterizing the interrupter case, blocks outstanding exteriorly and diametrically from said cap member for engagement by spring clips conventionally carried by the interrupter

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case, an integral boss formed with an axial bore upstanding centrally from the closed base of said cap member, a rotatable stem axially through said boss, an ear on and projecting radially from the stem end within the cap member for engagement within a notch conventionally characterizing the driven shaft of the ignition system, an opaque disc concentrically and perpendicularly fixed to the stem portion exterior of the cap member, a single opening intersecting said disc eccentrically of the stem, a separate, opaque housing shrouding said disc and closing against said cap member with the housing base adjacently covering the disc, notches in the open end margin of said housing embracingly accommodative of said blocks, a series of angularly-spaced like openings intersecting the housing base for successive registration with the disc opening in a disposition concentrically about said stem simulative of distributor cap contacts, a projection of said stem rotatably through the housing base, a pointer on said stem projection registered with the disc opening position, an electric bulb carried by said cap member within said housing and beneath said disc, and a circuit serving said bulb in shunt relation with the interrupter contact circuit whereby to illuminate the housing interior between said cap member and disc in automatic reaction to separation of the interrupter contacts.

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